Space Weather Technical Forecast

Issued on Tuesday, 26 April 2022 at 13:07 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: M-class flares (R1/R2 Radio Blackouts) likely, with a slight chance of X-class flares (R3 Radio Blackouts).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low, with just C-class flares in the last 24 hours. The two largest and most complex regions on the disc are AR2993 and AR2994 close together in the northwest quadrant. Both have been showing signs of simplification through this period, especially 2993. The remaining numbered regions are currently relatively simple with no significant activity. Two further regions are rotating onto the southeast limb - these are not yet fully visible so are difficult to classify at the present time, however some CME activity has been seen from over the limb before they rotated onto the disc. No Earth-directed CMEs have been observed in available imagery, however.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by the ACE and DSCOVR spacecraft, has been indicative of a gradual waning of the HSS from CH77/+. Wind speeds have declined from just below 450 km/s, to near 380 km/s. Density has been largely below average. Overall magnetic field strength, Bt, has been weak below 6 nT. The north-south component, Bz, varied weakly between +4/-5 nT. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was at background levels throughout. The high energy electron flux (greater than 2MeV) has been at background to moderate levels throughout. The associated 24 hour fluence was below the Active (1e8 integrated pfu) level on a very slight rising trend, with 1.17e7 integrated pfu recorded at 26/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be Low, with the possibility of some Moderate activity, and a slight chance of High activity. This is mainly due to two significant regions in the northwest quadrant, although these have simplified slightly recently. Further active regions are currently rotating onto the southeast limb, but these are not yet fully visible.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are currently expected during this period. The high speed stream from coronal hole 77 has continued to wane, with wind speeds now back to ambient levels. The next feature of note is coronal hole 78, which is forecast to connect with Earth during Day 3 (28 April) or perhaps early on Day 4 (29 April). Wind speeds from the previous rotation reached just above 550 km/s.
Geomagnetic activity is expected to be mainly Quiet through Days 1 and 2, becoming Unsettled to Active later on Day 3 as the high speed stream arrives, with a slight chance of a G1/Minor Storm interval in association with this feature.

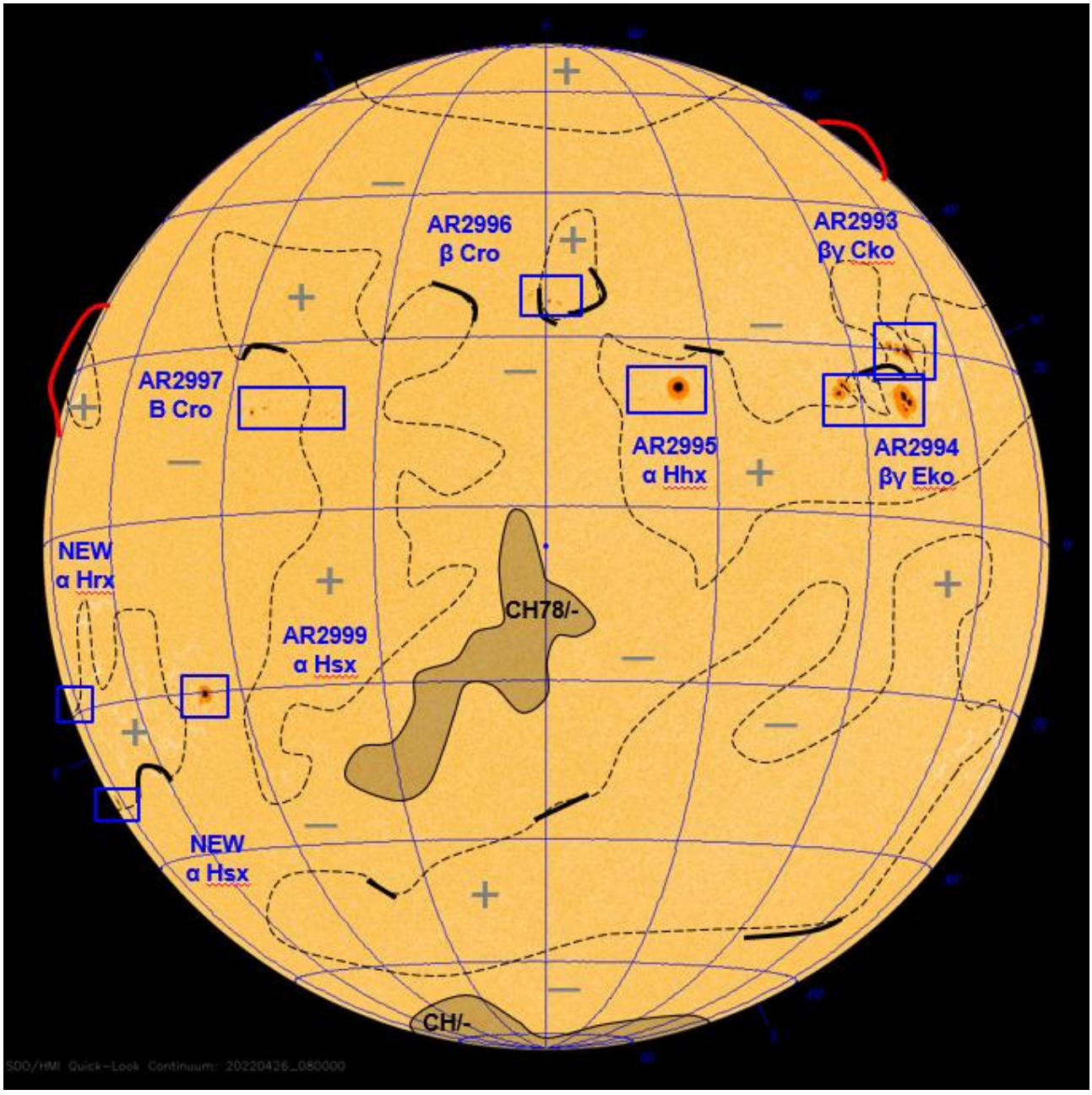
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is at background levels, and is most likely to remain so through the next four days. However, two significant regions are now transiting the northwest quadrant and together bring a slight chance

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

of solar radiation storms reaching Earth. The high energy electron flux (greater than 2MeV) is expected to be at mainly background to moderate levels, but with a rise possible later on Days 3 and 4 (28-29 April). Electron fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, with a rising trend towards the end of the period.

Figure 1. Solar Analysis Valid 26/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No Earth directed CMEs are currently expected during this period.

The high speed stream from coronal hole 77 has continued to wane, with wind speeds now back to ambient levels. The next feature of note is coronal hole 78, which is at centre disc, and is forecast to connect with Earth during Day 3 (28 April) or perhaps early on Day 4 (29 April). Wind speeds from the previous rotation reached just above 550 km/s. There are signs of a CIR at STEREO-A now, likely associated with this feature. As STEREO is currently 2.5 days away from Earth, that would fit with an arrival time later on Day 3.

Geomagnetic activity is expected to be mainly Quiet through Days 1 and 2, becoming Unsettled to Active later on Day 3 as the high speed stream arrives, with a slight chance of a G1/Minor Storm interval in association with this feature.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

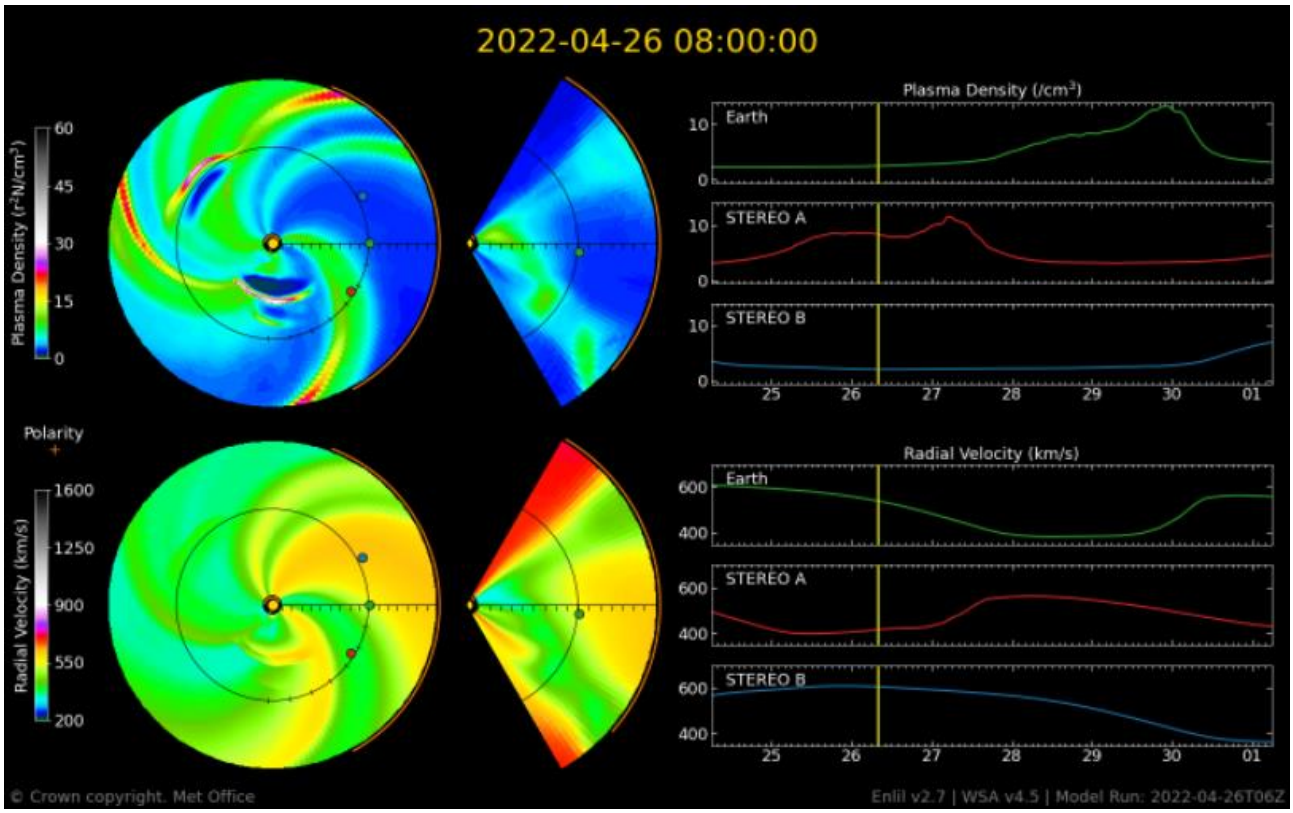
Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 2: Enlil forecast, which is too slow to reduce the high speed stream from CH77, as wind speeds are already near or just below 400 km/s. It is also too slow to bring in the next high speed stream from CH78, which from STEREO-A data is likely to arrive at Earth later on 28 April.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

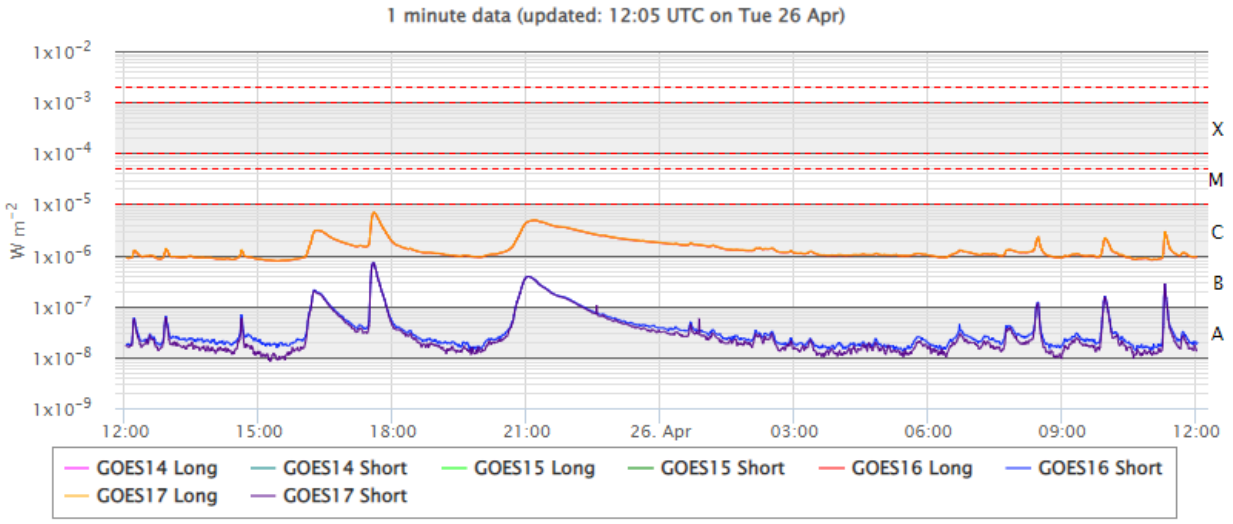
Radio Blackouts - X-Ray Flares:
Solar activity is expected to be mainly Low to Moderate through the next four days. There is also a slight chance of High activity.

The two most significant sunspot regions on the visible disc have been showing signs of some simplification recently, especially AR2993 (Cko/Beta-Gamma). AR2994 (Eko/Beta-Gamma) remains similar to the previous 24 hours, although with some splitting of the trailing spot. These regions are close together in the northwest quadrant, adding to the magnetic complexity in this area. The remaining regions on the visible disc are all relatively magnetically simple sunspot configurations. A number of filaments are being monitored for potential eruptions, especially in the western hemisphere which could result in an Earth-directed CME.

There are two further regions currently rotating onto the southeast limb, which have been numbered AR3000 and AR3001. Neither are fully visible yet, so it is difficult to tell if they are the leading spots of larger groups or not. There have been several recent farsided CMEs from this area, suggesting some activity in at least one of the spots near the southeast limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: X-ray flare trace from the last 24 hours, showing only C-class flares.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at Background levels, and is most likely to remain so through the next four days. However, AR2993 and AR2994 both bring the possibility of isolated high M-class to low X-class flares. As they continue to move across the northwestern quadrant there is a slight chance that solar radiation storms from any such events may be observed at Earth.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

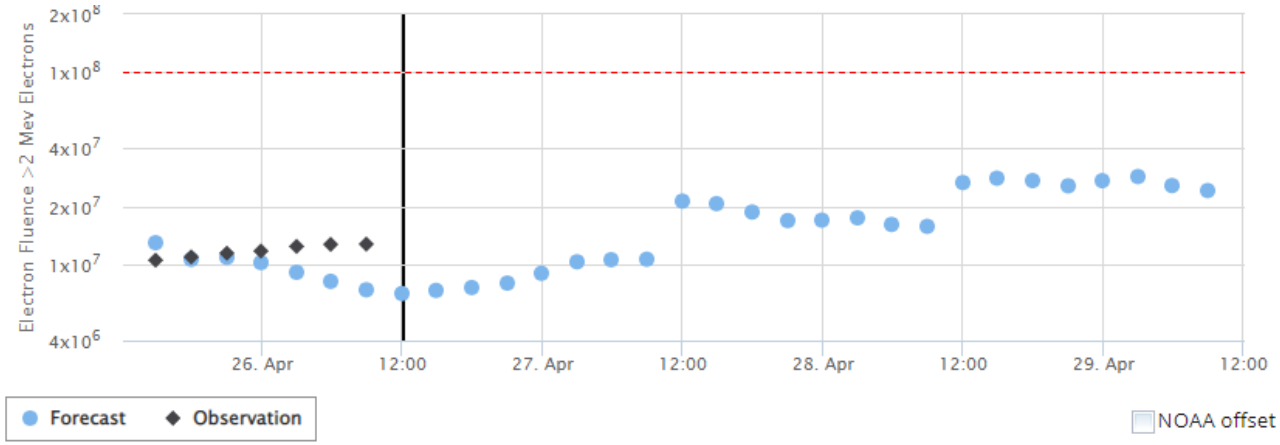
© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) at GEO is expected to be at mainly background to moderate levels through days 1 and 2, as the recent high speed stream does not appear to have given significant charging. Any CIR in association with the upcoming high speed stream on Days 3 and 4 (28-29 April) is likely to keep electron levels suppressed initially, but a build up of electrons in the radiation belts may occur, perhaps reaching GEO during Day 4 as the radiation belts decompress.

Electron fluence levels are well below the Active threshold with this expected to continue through the next four days. However, a rising trend is likely towards the end of the period due to the forecast high speed stream.

GEO Electron Environment	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: REFM forecast, which is currently giving good guidance.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.